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Models of Landscape Shaping in Exploited Quarries of Urban Area

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Abstract

The Research based on specificity of spatial planning from exploited quarries, as well as the possibility of modeling and redevelopments/repurposes are shown in this paper. Through the analysis of examples, this research will help to systemize different spatial relations in order to determine basic guidelines for future shaping of post-mining landscapes. In this manner, establishment of clear criteria of valorization and preservation of the surrounding, as well as the possibility of its shaping, are possible. And all of that with the goal of creating new landscape criteria in planning of the new and remediating of already existing mining landscapes in Montenegro. The research results can be applied for planning of future scopes of use and remediation in areas of exploitation in Montenegro using experiences of developed countries.

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Keywords: Urban area, urban planning, redevelopment, repurpose, landscape, urban environmental engineering, quarry.

1. Introduction

Contemporary methods of remediation and redevelopment/repurpose of exploited quarries create new identities in space and set new relations which implement in the existing landscape.

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Researches in this area, conducted so far, were directed towards methodological procedures of technical and biological remediation, as well as towards implementation of measures for environmental protection, while emphasizing the problem of ecological pollution of such exploited areas.

Through the analysis of examples, this research will help to systemize different spatial relations in order to determine basic guidelines for future shaping of post-mining landscapes. In this manner, establishment of clear criteria of valorization and preservation of the surrounding, as well as the possibility of its shaping, are possible. And all of that with the goal of creating new landscape criteria in planning of the new and remediating of already existing mining landscapes in Montenegro.

Remediated and redeveloped/repurposed areas of abandoned quarries can serve as areas of artistic and aesthetic creativity, as places with a story of historic continuity which should be continued both functionally and formatively in the future

From the protection and landscape preservation standpoint, in the area of Montenegro, we can find various exploitation areas out of which, many are located in the area of national parks, as well as the large number of wild and unplanned open mines. Even with the legal obligation, the quarry remediation method with landscape restoration is not consistently implemented; on the contrary, it has remained in the state of disrepair [1-12].

Today, new methods of landscape restoration are wanted in the world, which is not the example of mines in Montenegro which were only the area of production, during the time of exploitation. Fig. 1

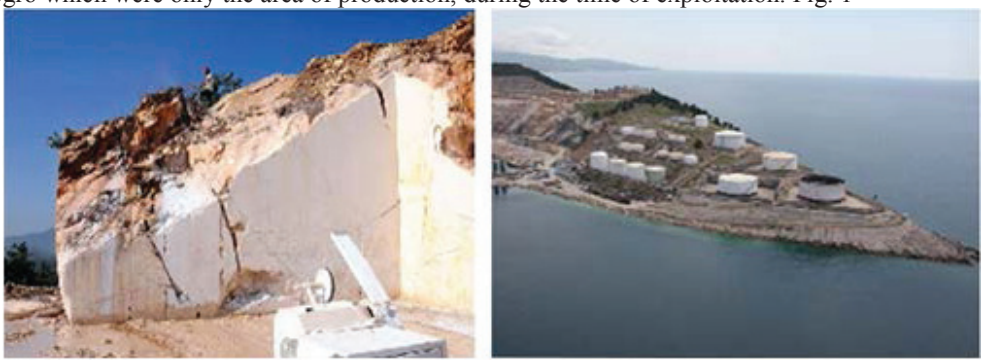

Fig. 1. Quarries Visocica in Spiz and Volujica in Bar.

2. Methods

A conflict between spatial planning documentation and exploitation plan exists in Montenegro. Due to lack of adequate regulation and supervision, illegal stone exploitation is expressed [1]. Legal obligation requires re-cultivation which represents mining works performed in the exploitation area due to remediation of areas degraded by mining works in accordance with the mining design [2].

In the region, countries of EU, legal and planning regulations define The Policy of Mineral Resources Management, certain elements are given through:

- The concept of sustainable development: „Sustainable Europe for a better world: sustainable development strategy of European Union in 2001. Experiences in the countries of EU show that spatial planning has a crucial impact to exploitation of mineral raw materials.
- Spatial plans which provide an information (in detail, descriptively and with graphical annex) of where exploitation of mineral raw materials is acceptable, and where it's not acceptable.
- The procedure of obtaining approvals for exploitation based on the assessment of the impact to the environment
- Insurance of financing of remediation works through mechanisms of EU Legislature, which could be achieved via closed funds, bank warranties and other forms of insurance and they are a compositional part of the exploitation permit.
- Monitoring ensures following of regulations, proper mining practice and environmental protection.

In Montenegro, mineral raw material management is defined by The Law on Mining (Official gazette of Montenegro no. 65/08, 74/10); The Law on Environment (Official gazette of Montenegro, no. 48/08, 40/10, 40/11); The Law on Natural Protection (Official gazette of Montenegro, no. 51/08, 21/09, 40/11) [3] . The Law on Spatial Development and Construction of Structures (Official gazette of Montenegro, no. 51/08, 40/10, 34/11, 47/11, 35/13, 39/13, 33/14) [4]

The following elements have been defined: of sustainable development; rational use and protection of space and natural resources; protection of integral values of space; protection and improvement of environmental state; harmonizing of interests of both space users and action priorities in space. In the area of Montenegro, there is inconsistency between spatial planning documentation and sectorial development plans, due to lack of sectorial data base, outdated topographic surveys and lack of data base regarding following of condition changes in space from the municipal, regional and state point of view. Also, in the area of Montenegro, there is no a regulated remediation method of not used quarries – abandoned quarries which remained in space as the consequence of irresponsible inspection supervision, insufficient allocation of funds for remediation, non-implementation of monetary sanctions for illegal exploitation, slow and inefficient implementation of legal obligations and similar [5].

Regarding that area, modern experiences in Montenegro stop at the re-cultivation design elaboration, while there are no clear guidelines and criteria for the most appropriate remediation and redevelopment/repurpose type. Designs mostly relay on technical remediation methods determined by mining designs, which secure the terrain stability, along with the proposal of biological restoration method. Participation of architects, urban planners in these tasks is not common and that leads to uniform (same) proposals, solutions with insufficiently developed sensibility for quarry issues and formative component of the solution and testing of redevelopment/repurpose possibilities is still making way for ecological access. In accordance with spatial planning documentation, targeted remediation can be achieved by shaping, i.e. spatial arrangement according to special requirements of future intended use, such as

economic, touristic, sport-recreational and other. Targeted remediation can additionally ennoble the excavated area and affect positively the decision on acceptability of superficial mine for exploitation of mineral raw materials when it does not have the good evaluation in terms of favorableness. Fig. 2

Fig. 2. Abandoned quarry Bigra in Savnik and Crveni bokit in Kamenari.

3. Modern remediation examples

Various engineering professions are included in development of post-mining landscapes, starting with the urban planners, landscape architects, designers of hydro-technical infrastructure and finally, architects as shapers of micro structure. Development of these cultural landscapes requires new ideas and originality, and the process of their restoration should strive to innovative solutions and new possibilities. Fig. 3.

Fig. 3. Quarry Holderbank, Schumel Switzerland, landscape architect: Hars-Dietmor Koeppel, remediation plan 1997 [7]

We will mention four models i.e. concepts of quarry remediation access and their redevelopments/repurposes are:
1. model: Landscape re-cultivation
2. model: Park re-shaping
3. model: Showing by architecture
4. model: Land art – artistic showing

3.1. 1 Model: Landscape re-cultivation

Its goal is returning to original state or, at least, what's the most similar to it („to return the nature what has been taken from it") and re-establishment of natural balance. It is a complex and long-term process in technical sense. It is based on application of various methods of biological remediation (application of new humus layers, stabilization of seismic areas, selection and planting of appropriate plant species) which allow and help the natural restoration and returning and settlement of various plant and animal species.

The ultimate goal of the method is as greater integration in surrounding natural landscape as possible. It is applied on abandoned exploitation areas on which new use or economic interest are not planned. Its goal isn't to attract the large number of new users which could call to question already weak natural balance. Tab. 1.

Table1. Basic features of the model – landscape re-cultivation

Exploitation type	Position	Relation between the quarry and the surrounding	Intervention form	New use	Added values
Technical construction stone	Distant from the urban center	-fitting into the landscape - hiding	-planting of mainly autochthonous vegetation -introduction of water elements	-without use, education, scientific purpose, multi-purpose plateau, fishing, mountaineering, cycling	-ecologic, functional, aesthetic

3.2. 2 Model: Park re-shaping

The idea is to use re-shaping to create areas of completely new landscaping features and contents. Redevelopment/repurpose of former quarries into park and/or recreational areas, apart from new shaping, suggests new intended uses which enrich the future use and ensure the economic validity. The assembly of vegetation elements and often, terrain modeling do not start exclusively from technical biological requests, but from shaping performances, from future use and the need of new environment and identity creation. Fig. 4.

Fig. 4. Quarry Hostal, Cituadella, Menorca, Spain (1996), Landscape architects Maria Bennasar, Virginia Pallares, Joan Vilardeii [8]

Table2. Basic features of the model – Park re-shaping

Exploitation type	Position	Relation between the quarry and surrounding	Intervention form	New use	Added values
-architectural - construction stone -technical construction stone	-in the city, - along with smaller settlements, easily available from cities	-visible quarry -emphasis, accentuation -new re-shaping	-planting of vegetation -terrain modeling -arrangement (of communications, retaining walls, urban equipment...) - placement of sculptures -introduction of water elements (artificial lake, swimming pool) -architectural structures (resort, square, catering...)	-picnics -recreation -city gatherings -theme gardens (botanical, artistic, sculpture and similar)	-ecologic -aesthetic -functional -cultural -historic

3.3. 3 Model: Showing by architecture

Quarries which used to be located on the city's periphery became a compositional part of the city's tissue, which was all influenced by spreading of cities and urbanized areas. The quarry area, detained inside of the city structure becomes particularly interesting construction area for various new intentions and uses. Fig. 5.

Fig. 5. Pierres at vacances housing, Cap d'Ail, France (1988/1992) Author: Jean Nouvel.

These areas with least natural vegetation elements are experiencing re-shaping of devastated areas almost exclusively using the architectural elements, without a striving to return the nature what has been taken from it. Tab. 3.

Table 3 Basic features of architectural model (model: introduction of architecture)

Exploitation type	Position	Relation between the quarry and surrounding	Intervention form	New use	Added values
Architectural construction decorative stone	-in the city -in immediate vicinity of the city	-visible quarry -emphasis, accentuation -modern architectural shaping -sharp difference	Construction of architectural structures	-sport and recreation -culture (museum, opera) -tourism -theme gardens	-functional-aesthetic-cultural-historic

3.4. 4 Model: Land-art artistic showing

As a value, art has often recognized quarry areas, and it strived to find space of its own research in them, spaces of open galleries and parks with sculptures, temporary and permanent artistic interventions. Appearance of land art only enhanced that striving, at the time when devastated landscapes of industrial age became favorite places of creating avant-garde (landscape) art.

The goal of a model of artistic showing is not an awakening of nostalgic feelings regarding original features of a former place; it aims to point out to the strength of an art work and action as an initiator for recovery of devastated landscapes. That is how a whole new sense emerges, of different meaning and poetics. Their use is very different – starting with emphasized viewpoints up to the experimental scenery, and their goal is to send multi-meaningful artistic message, Tab. 4.

Table 4 Land-art artistic showing

Exploitation type	Position	Relation between the quarry and surrounding	Intervention form	New use	Natural values
					
Architectural-construction stone	-in the city, out of the city	- contrast	-artistic (land art, sculpture, painting)	-park of sculptures, artistic installation	- aesthetic, cultural

Fig. 6. Land art park Dionyssos, antique quarry, Attica, Greeca, author: Kouzoupis&Gollanda

4. Summary

Analysis of contemporary examples was inducted into this paper with the intent to indicate the possibility of establishing new criteria for valorization and preservation of the landscape and the

possibility of its shaping in planning the new and remediating already existing mining landscapes in Montenegro. Obtained results could be applied for planning of future use and remediation scopes in the exploitation areas in Montenegro, when determining models of remediation and redevelopment/repurpose of the quarry.

It is possible to establish new spatial relations which contribute both fitting into the landscape and creating of the new identity by new and original accesses. Spatial planning of abandoned quarries must be particular, since each of these areas is unique, and each solution's goal must be establishment of the balance between social, economic and ecologic requests. Examples point out to inclusion of various professions, where architectural and artistic prevail. Development of new cultural landscapes seeks for originality and avant-garde and their restoration should strive to new solutions and new possibilities, so that areas which are considered devastated, can become unique places of social, cultural and artistic values.

The research has shown that spatial planning of abandoned quarries should be exemplary particular. Each one of such areas is unique, and when solving it, it is required to achieve balanced relation between social, economic and ecologic requests. That is an indicator of the fact that development of these new cultural landscapes requires avant-garde and creativity, and their restoration process should strive to innovative solutions and new possibilities (those are the standpoints and, also, one of the main guidelines for shaping of post-mining landscapes specified in IBA Congress in 2009).

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